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ABSTRACT

This 3-part manual is designed to assist school officials understand the principles of Integrated Pest Management and aid them in implementing those principles into a comprehensive pest control program in their facilities. Developed for Illinois, this guide can be applied in part or in total to other areas of the country. Part 1 explains what an IPM program is, its disadvantages and advantages, and costs. Part 2 examines priority setting in the steps for building an IPM program in schools. Part 3 offers tips for using an IPM program effectively against such pests as cockroaches, pantry pests, ants, spiders, wasps, termites, mice, head lice and "mystery bugs." Appendices provide a pictorial key to some common adult cockroaches and information on distinguishing between termite and ant swarms. (GR)

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A Practical Guide to Management of Common Pests in Schools

Integrated Pest Management

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Developed by
Illinois Pest Control Association • Illinois Department of Public Health
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Illinois Pest Control Association, Illinois Department of Public Health,
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Approved by the IPCA Board on March 10, 1999

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Disclaimer

This publication contains pesticide recommendations that are subject to change at any time. These recommendations are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. Due to constantly changing labels and product registration, some of the recommendations given in this writing may no longer be legal by the time you read them. If any information in these recommendations disagrees with the label, the recommendation must be disregarded. No endorsement is intended for products listed, nor is criticism meant for products not listed. The authors assume no liability resulting from the use of these recommendations.

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Part I
What is Integrated Pest Management?

Prologue

This manual is designed to help school officials understand the principles of Integrated Pest Management and to aid them in implementing those principles into a comprehensive pest control program in their facilities.

Successful pest control has relied on the basic concepts of Integrated Pest Management (IPM) since human beings first attempted to protect their health and property from pests. In 1955 the National Pest Control Association produced one of the first manuals that dealt with the various steps involved in IPM as we define it today.

The rapid development of the modern residual pesticides during World War II made pest control very effective, very economical, and very easy to accomplish. The use of these residual pesticides was so effective that in many instances when problems did occur, or clients demanded an even more total elimination of pests, the answer was to simply use more pesticides. There have been two consequences of this trend of accelerating pesticide usage. In a few instances "super" pests have appeared that are resistant to common pesticides. Additionally, a growing segment of our population has become alarmed over the possibility that adverse health effects of this trend might occur.

In the past five decades the research and development work done by chemical manufacturers and the research done by governmental agencies and universities has greatly increased the knowledge of the biology and habits of pests. As this body of knowledge grew, our ability to control the pests increased dramatically. Today, this expansion of our current knowledge allows us to control pests more effectively while using minimum amounts of pesticides. An objective of this manual is to address both of these issues as they may impact schools.

Definition of IPM

Integrated Pest Management (IPM) in schools involves the cooperation between school staff and pest control personnel or other specialists to use a variety of nonchemical methods as well as pesticides, when needed, to reduce pest infestations to acceptable levels and to minimize children's exposure to pesticides. As defined by the Structural Pest Control Act (225 ILCS 235/3.24) IPM is a pest management system that includes the following elements whenever possible:

- identifying pests and their natural enemies;
- establishing an ongoing monitoring and record keeping system for regular sampling and assessment of pest and natural enemy populations;
- determining the pest population levels that can be tolerated on aesthetic, economic and health concerns, and setting action thresholds where pest populations or environmental conditions warrant remedial action;
- preventing pest problems through improved sanitation, management of waste, addition of physical barriers, and the modification of habitats that attract or harbor pests;
- reliance to the greatest extent possible on nontoxic, biological, cultural or mechanical pest management methods, or on the use of natural control agents;
- when necessary the use of chemical pesticides, with preference for products that are the least harmful to human health and the environment; and
- record keeping and reporting of pest populations, surveillance techniques and remedial actions taken.

Advantages of IPM

- Detects, identifies, and manages a potential pest problem before it becomes a major infestation.
- Reduces the use of pesticides or other repeated responses to minor pest problems by evaluating the need for such efforts in a given pest situation.
- Reduces the potential liability from parents concerned about exposure of their children to pesticides in the schools.
- Achieves "long-term" control of some pests through improved sanitary practices and structural modification to "build out" pests rather than through sole reliance on the routine use of short-lived pesticides.
- Provides a written record of all pest activities observed in the school during the program and a detailed account of how any problems were handled.

Disadvantages of IPM

- Requires greater time and commitment of all participants: school staff, pest control technicians or other specialists.
- Requires additional paperwork and communication by both school staff and pest control personnel to help produce a more directed and balanced pest control program.
- May require ongoing training so that proper cooperation continues between school staff and pest control personnel.

Costs of IPM

An IPM program may require additional labor for more inspections by the pest control technician. Additionally, implementing nonchemical control procedures, such as building modifications or repairs, monitoring and evaluation efforts, and procedural changes in daily routines may result in increased costs. However, improvement of the physical condition of the school may result in savings in other areas, such as improved energy efficiency for heating and or cooling.

Part II
Setting Priorities for IPM

Steps to Build an IPM Program

Integrated Pest Management recognizes that not all bugs are bad and need to be killed immediately. On the other hand, some insects and rodents can be very dangerous to the safety or health of the occupants of the facility, and must be eliminated as quickly as possible. Therefore, it is very important that the school staff and the pest control operator or school pest control technician establish well-understood guidelines of action in response to reports of pests present in the facility.

Step 1: Determine Tolerance of Pest Activity

Roaches. There should be no tolerance for roaches in any area of the facility. They can carry several pathogens that can cause health problems under certain circumstances. Problems can range from salmonella poisoning to severe asthmatic reactions in young children.

Cereal Pests. These infest flour and other cereal grain products, and should not be tolerated. Ingestion of insects or pathogens in infested grain products can cause illness in anyone who consumes the food.

House Flies. In nonfood areas, these are more of a nuisance than a threat to the health of the children and staff. Thus, an occasional house fly in a nonfood area should not be cause for alarm. If there are many flies in a nonfood area, this could be a sign of a sanitation problem that needs to be corrected. House flies in a food area cannot be tolerated. The pads on the feet of the flies are sticky and will pick up debris from wherever the fly lands. If the fly should land on garbage or animal feces and then fly into the kitchen and land on exposed food, some of that debris will be transferred to the food.

Other Flies. Flies such as the Cluster Fly or the Carrion Fly are often found throughout a school building. Small numbers do not constitute a health threat, but they can be a nuisance and should be treated as such. However, many flies in a room or area may indicate a problem that needs to be investigated.

Ants. In a food area they should be eliminated quickly as they may contaminate open food, although to a lesser degree than flies or roaches. In nonfood areas they are strictly a nuisance and should be handled as such. Ants outside a building that are *not* migrating into the building are more beneficial than detrimental and should be left alone.

Occasionally Invading Pests. These include such pests as Crickets, Spiders (except Brown Recluse and Black Widow Spiders) Boxelder Bugs, Millipedes, Clover Mites (not Fowl Mites), Springtails, etc. These insects are not a health threat and only become a nuisance if they appear in large numbers or they are found near open food areas.

Stinging or Biting Insects. These can cause a serious health threat to some children and adults who are hyperallergic to stings or bites. For this reason, there should be no tolerance for these pests either inside or outside of the building. The most likely pests found in Illinois schools in this group are bees, yellowjackets and other wasps, brown recluse and black widow spiders.

Mice. There should be no tolerance in any area of the school for mice. They contaminate food by gnawing into unopened packages and by urinating or defecating on open food or food preparation surfaces. Their constant gnawing can cause damage to the building and, in extreme cases, may cause an electrical short and resultant fire. If a student or staff person attempted to pick up a mouse, he or she could receive a rather nasty bite.

Rats. There should be no tolerance for rats inside or outside of the school building at any time. Like mice, they can contaminate food through gnawing into packages and urinating or defecating on open food or food preparation surfaces. Their gnawing habits can cause damage to the building and they could cause a fire by gnawing into an electrical wire. A bite from a rat can be more serious than one received from a mouse.

Birds. In general birds should not present a problem for a school. However, bird nesting on school buildings should be discouraged to prevent accumulation of droppings that may harbor pathogens and to prevent migration of pests such as fowl mites or carpet beetles from an abandoned nest into classrooms.

Raccoons. These are protected animals and can only be removed from a school by a specialist who is licensed by the Illinois Department of Natural Resources. Raccoons are nocturnal and normally would not contact students or staff. However, they should be removed from the facility as they can be physically destructive to the building. They can get into garbage and create a mess that is attractive for flies and other pests. Additionally, they can carry fleas, and there have been a few isolated cases where children have been bitten by raccoons.

Squirrels. These are protected animals and can only be removed from a school by a specialist who is licensed by the Illinois Department of Natural Resources. Squirrels can cause physical damage to a building and they carry fleas. They tend to be more "people tolerant" and will feed on food scraps found on the school grounds or in the garbage area during the daytime. This will increase the possibility of a student coming in contact with one.

Bats. These are protected animals and can only be removed by a specialist who is licensed by the Illinois Department of Natural Resources. Although bats are nocturnal and are beneficial in their feeding on night-flying insects, they can pose some problems for a school. If they are allowed to roost in a building for a long time, the accumulation of bat droppings can become a health hazard, and can cause physical damage to the building. If a sick bat on the playground is handled by a student, there could be a serious health problem.

Step 2: Determine Response Times

If IPM is to succeed, response to a pest problem must be both timely and effective. However, the facility managers must recognize that some pest problems are more serious than others. For example, a pest problem that threatens the physical safety of students and/or staff should have a higher priority than the mere presence of a single nonthreatening bug. Consequently, facility managers and their pest control staff may want to agree on the response times for pests (Table 1).

Table 1. Response by Pest Control Staff to Pest Problems

Response Time	Condition	Pest
Not over four hours	Potential physical harm to students or staff	Rodents where students or staff are likely to contact them
		Wildlife (raccoons, opossums, feral cats, bats, etc.) where students or staff are likely to contact them
		Stinging or biting insects
One working day	Potential medical harm to students or staff	Fleas, Lice, Bed Bat bugs . d Poisonous spiders
One working day	Potential for food contamination	Cereal pests, Roaches, Rodents, Ants in kitchen or food storage areas and Flies around food
One to two working days	Sighting of large numbers of nonthreatening bugs	Ant or Termite colonies in the building; movement into the building of Millipedes, Crickets, Boxelder bugs, etc.

Step 3: Establish Periodic Inspection and Reporting System

IPM programs can be successfully implemented by trained "in-house" school employees or by contracting with a pest control company. A combination of in-house and contracted functions may be mixed and matched to the needs and capabilities of the school system. Both approaches have advantages and disadvantages and individual school systems must decide what is best for them.

Inspections by Trained Personnel. The single most important step in the IPM program is the periodic (not less than monthly) comprehensive inspection of key areas by a trained individual, combined with the evaluation of the documented reports of pest sightings by staff members. This is the foundation upon which all other IPM actions are based. The periodic inspections may be done by a staff member, a specialist with the school district, a local health department person or a structural pest control technician. This person must be able to:

1. know the life cycle and habits of pests most likely found in schools;
2. know where the signs of these pests are most likely to be found in the school facility;
3. be familiar with the many unusual ways these pests can enter the school facility;
4. have access to all areas of the facility;
5. identify or obtain an accurate identification of any specimen provided by the school IPM coordinator;
6. talk to the staff person who made out the pest sighting report, evaluate the information and make a decision on any subsequent action to be taken;
7. be familiar with pesticide safety procedures and respond to emergency situations as the need dictates;
8. make written recommendations for the upgrading of the facility and for the changing of procedures to diminish the ability of pests to get in or to find harborage areas in the facility;
9. follow up on the recommendations and/or changes in procedures to confirm that they have been completed; and
10. provide a detailed written report for each month.

If the school does not have a person on staff who can meet the above qualifications, then the principal should appoint a staff person to act as the *IPM coordinator* for the school who will work with the above person. (The IPM coordinator may need to attend appropriate training to work effectively with pest control personnel.) The IPM coordinator's duties should include the following:

1. receive and possibly make preliminary evaluation of all written reports from other staff persons including
   a. reports of an occasional invader; these should be handled in accordance with the procedures set up under the "response times,"
   b. reports of unknown pests should be passed on to the technical person described above for evaluation,
   c. reports of those pests deemed to need immediate action should be passed on to the person designated to handle this situation as soon as possible.
2. coordinate any pesticide applications with the many activities that are common in most schools with the goal being to minimize exposure of students and staff to pesticides;
3. ensure that all areas of the school are accessible for inspection and/or application of control methods;
4. check any monitoring devices such as sticky traps between the periodic inspections, if deemed advisable;
5. be in charge of seeing that structural changes or changes in procedures are carried out;
6. maintain written reports and recommendations in a file for review as needed; and
7. review all written reports every six months and ensure that recommended changes are completed.

Guidelines for Periodic Inspections. In large facilities, a pest control technician will want to become familiar with the entire operation before making an inspection. Pests can occur in machinery, stacked products, dumpsters, product spills, etc. In kitchens and storage areas, excessive clutter, poor lighting, unaccessible storage areas and rooms located above or below infested materials are special target sites.

1. All inspections should be conducted with bright flashlights. A knife or spatula, a good hand lens, screwdrivers and mirrors are also useful equipment.
2. Flushing agents (small aerosol cans of pyrethrin insecticides used to aid the inspection of voids) can be used, but care must be taken not to contaminate foodstuffs or expose occupants of the facility.
3. Inspect the pathway taken by incoming supplies to detect problems.
4. Special attention should be given to all spills. Check for dead insects and tracks in spilled products or dust.
5. Inspect the back of pantry shelves, floors under shelves and all dark areas.
6. Traps that use a sex attractant (pheromone) are available for nearly all stored product pests and roaches, which may be used to conduct routine inspections.
7. Keep written inspection records. Results of inspections and recommendations for changes by management or maintenance should be written in an easily understandable form.
8. Be safe. Use bump hats and be careful of hot machines and electrical hazards.

Monitoring and Reporting by School Staff. The pest control technician should obtain the assistance of other staff members to monitor pests throughout the school (Table 2). This will enable the pest control technician to concentrate on kitchens, food storage areas and other rooms where pest invasion is likely. To establish an effective monitoring system, individuals must be responsible for monitoring particular areas. Otherwise new pest infestations may be missed because everyone assumed that someone else was responsible for reporting a pest sighting.

Because the pest control technician is not always in the facility, other staff must be relied on as pest monitors. Staff should file *written* pest sighting reports, which are important to an effective IPM program. Otherwise, the message to the pest control technician may become confused or lost during the many activities in a busy school day. However, the reporting form should be concise and require only necessary information. A cumbersome or long reporting form may be looked on as burdensome by staff members and thus may never be filed. Consequently, a new pest infestation may become established because the staff did not want to take the time to fill out a long report form. Table 3 is a simple pest sighting report that can be modified by schools to fit local needs.

Table 2. Areas to Be Monitored - Who Monitors Each Area

Area	Cooks	Expert	Maintenance	Teachers & Staff	Students
Kitchen & storage areas	X	X	X		
Restrooms			X	X	X
Locker rooms		X	X	X	X
Utility rooms & janitor closets		X	X		
Entrances & hallways			X	X	X
Classrooms			X	X	X
Outdoors		X	X	X	X
Dining area	X	X	X	X	X
Staff lounges		X	X	X	
Student lockers			X		X

Table 3. Simplified Pest Sighting Report

Description of pest seen or sample if available	
Number of pests seen	
Exact location where pest was seen	
Time and date of sighting	
Name of person making report	

Check with Key Facility Personnel. A routine monthly inspection schedule should be established by staff for kitchens, product storage areas and other key locations that are most likely to be subject to pest invasions. The pest control technician should check with key personnel as part of the monthly inspection. Without a standard inspection procedure,

conditions that may encourage pest invasion or proliferation may be overlooked.

As with the pest sighting report, the inspection checklist should be as concise as possible so not to burden staff with excessive paperwork. Table 4 is an example of a monthly inspection report for a school kitchen and cafeteria. A monthly inspection report may be needed for other sites including restrooms, utility rooms and janitor closets, entrances, hallways and outdoor areas.

Table 4. Facility Monthly Inspection Check List

Date:	Pest Sightings	Location/Numbers	Action to be taken
Main Kitchen	South wall		
	Soup kettles		
	Ovens		
	Tray assembly area		
	Bakery		
	Tray conveyors		
	Day storage		
	Storeroom		
	Salad prep area		
	Cart storage		
	Dishwashing area		
	Storeroom		
Cafeteria	Serving line		
	Dirty dish conveyor		
	South and West Walls		
	Checkout area		
	Condiment island		
	Small dining room		

Check of monitoring stations. At least once per month, the pest control technician should check glue traps or other monitoring devices for evidence of pest infestation. The presence or absence of captured pests should be recorded so that areas of the school susceptible to pest infestation can be identified.

Step 4: Investigate Pest Sightings and Apply IPM Measures

The pest control technician should file a monthly report of pest infestation with school officials. The report should include the significance of the infestation as a health or nuisance issue, the type of action taken by the pest control technician and any recommendations to school officials to reduce or eliminate conditions that encourage pest infestations. An example of a pest sighting/infestation report may be found in Tables 5 and 6.

Table 5. Pest Sighting / Infestation Report

Site:		Action to be taken	Details
Pest(s):	Action taken by pest control technician	Further Monitoring	( ) Yes ( ) No If yes, see attached form
Health ( )		Pesticide Application	( ) Yes ( ) No If yes, see attached form
Nuisance ( )		Trapping	( ) Yes ( ) No If yes, see attached form
Safety ( )	Recommended action taken by school maintenance staff	Physical changes	( ) Yes ( ) No If yes:
Other:		Procedural Changes	( ) Yes ( ) No If yes:
		Source elimination	( ) Yes ( ) No If yes,
	Results of communication to key school personnel		

Table 6. Record of Pest Control Procedures

Method of Control	Comments	
Pesticide ( ) Yes ( ) No	Site of application:	Application Method:
If yes, time and date of application:	Pesticide used:	Common Name & EPA Reg #:
		Amount Used:
	Target Pest(s):	Expected results:
Nonchemical Control ( ) Yes ( ) No	Time and date:	Site:
	Target Pest(s):	Method of Control:
Traps ( ) Yes ( ) No	Location of traps:	
If yes, type of traps:	Expected results:	
Mechanical exclusion ( ) Yes ( ) No	Building / equipment repairs:	Screening:
If yes, method:	Harborage reduction:	Other:
Procedural Changes ( ) Yes ( ) No	Merchandise storage:	Waste disposal:
If yes, method:	Food handling:	Equipment Cleaning:
	Housekeeping:	Recycling programs:
	Expected results:	

Step 5: Follow up and Evaluation

Both managers and pest control personnel must be aware that pest problems may change. Pests may actively invade schools or be introduced on dry goods, food packaging, pallets, school bags and many other sources. Consequently, the IPM program should be reevaluated periodically. Information from pest sighting reports, visual inspections, glue traps and other monitors should be kept in a central log for reference. Additionally, school administration must insure that changes in food handling procedures or repairs recommended by the pest control technician are acted on in a timely manner.

Periodically, pest control staff and/or school personnel should review records to decide if pest numbers are at a minimal level or are increasing. A quarterly evaluation of the IPM program is important because a variety of events in the school can affect the long-term success of the IPM program. Consequently, all aspects of the school's pest management program must be periodically reviewed at least quarterly to determine if a pest problem is chronic or temporary. The quarterly evaluation can also be used to determine if past problems have been eliminated and if new problems are appearing. If a pest problem occurs repeatedly over a three-month period, the problem may be chronic. For example, mice seen repeatedly in the same area suggests they are entering from a harborage area like a hidden crawlspace void. In contrast, temporary or seasonal problems may occur about the same time each year, but usually are over in a few days. Other changes in the school's operations can affect the functioning of the IPM program:

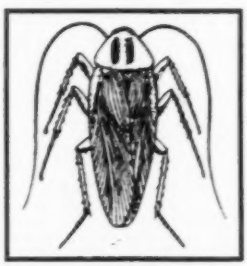
- changes in use patterns like the addition of evening or summer classes;
- in urban areas, nearby construction causing an invasion of rats;
- in rural areas, seasonal invasion of mice from nearby fields following grain harvest; and
- invasion of flies produced from decaying material deposited by stream flooding and receding.

It is important to maintain contact between administrators and pest control staff, otherwise, the initial priority given to the IPM may be lost among the day-to-day demands of a busy school schedule.

Part III
Tips for Effective Pest Management

Cockroaches

Except for size, all cockroaches are relatively similar in overall shape and appearance. They are most active at night and stay in the dark whenever possible. (When they are seen in the open or in the light, it usually means that a large infestation is present.) Cockroaches also like to hide in cracks and crevices where their bodies can touch surfaces both above and below. As they grow to adulthood, they will seek hiding places (harborage) for their larger size. Cockroaches do not uniformly infest one room or all rooms. Knowing the basic biology of cockroaches give the pest control technician important clues to the source of a cockroach infestation. By considering the habits discussed below, one can increase the effectiveness of a cockroach management program.



German Cockroach

The four most common kinds of cockroaches may be divided into two groups, depending on how they are managed. The "small" cockroaches include the German cockroach and the brown-banded cockroach; the "large" cockroaches are the oriental cockroach and the American cockroach.

- ***Management of Small Cockroaches*** - The German cockroach and the brown-banded cockroach are responsible for most pest complaints and pesticide use in public and commercial buildings. The degree of success of the control program depends not only on insecticides, but on management attention to good maintenance and housekeeping practices. Cockroaches and their egg capsules are being constantly introduced into buildings in packaging and boxes. *Consequently, both pest control staff and management must understand that an effective control program must include monitoring and inspection.*

- ***Management of Large Cockroaches*** - Although these large insects may wander along pipes throughout a building, in most parts of the county they live mainly at ground level or below. Prevention and treatment should focus on warm, moist areas such as basements, boiler rooms, pipe chases, sumps and elevator or sewer shafts.

MANAGEMENT OF SMALL COCKROACHES

The ***German Cockroach*** adult is 1/2 inch long with two black stripes behind its head on the "pronotum" (Appendix I). Young cockroaches (nymphs) are brownish black with a pale brown band down the middle of their back. The German cockroach is not only the most common cause of indoor pest problems, but also represents the largest number of control failures of any structural pest. It is most successful at infesting human structures and withstanding pest control activity. Successful cockroach control programs use several methods to bring the infestation under control.

Behavior and Harborage
Groups of cockroaches (aggregations) live in areas of high humidity and nearby food. They will find harborage (hiding places) into which they can fit closely. As the number of cockroaches increases and favorable harborage is filled, roaches are forced to leave the aggregation or remain in less favorable harborage. They are most active just before dawn and after dark.

To cockroaches, the most desirable harborage is in and around refrigerators, stoves, under sinks, and undisturbed cabinets, which provide both protection and food. Kitchen areas with high humidity, sink traps, leaking faucets, standing water and wet sponges are attractive to cockroaches. They also may be found in washrooms, because of their toilet bowls, sinks, wet wash cloths, and sometimes, water heaters. While there is less food in washrooms, food areas are usually nearby or available through holes around plumbing pipes. These pipes provide additional harborage and areas where cockroaches can enter adjacent rooms.

In schools, German roaches are often found in student lockers or gym lockers. The two principle reasons for this are food left in lockers and roaches transported from home in the student's book bag or coat. In kitchen areas, roaches are most often brought in on supplies. What may be overlooked is that often nonfood supplies are a greater source of roach infestations than food supplies. Vending machines and recycling bins can also provide a frequently overlooked source of roach problems.

German cockroaches are not likely to leave favorable harborage unless conditions change. Such changes can be caused by:

- increase in the cockroach population,
- intensive cleaning,
- reduction of temperature or humidity,
- mechanical exclusion or
- pesticide applications.

If cockroaches find new locations with favorable conditions, they can move from one harborage to another, or develop new infestations. Outdoor infestations are found only outside heavily infested structures from which steady cockroach migrations occur and near dumpsters and garbage cans.

- ***Control and Management***

Inspection
With Flashlights - An active inspection with a bright flashlight is the most thorough method of locating cockroaches. The technician can search dark, undisturbed, or remote places of cockroach harborage that have not been properly inspected. Hand mirrors, magnifying hand lens or other small tools may be helpful to some technicians. *Identification of harborage is critical to an effective cockroach control program.*

With Traps - Use of sticky (glue) traps is a common inspection or monitoring method used for cockroach detection. Correct trap placement depends upon the technician's understanding of cockroach food-seeking (foraging) habits; place sticky traps behind kitchen appliances, in cabinets, supply rooms and similar locations.

Habitat and Harborage Reduction
Speak to the facility staff in a friendly, knowledgeable way. Pest control technicians should explain to both staff and management that often changes in facility operations can reduce or eradicate the insect problem. These recommendations should include how staff can eliminate or restrict materials that support buildup of cockroach populations. *Site staff should understand that pesticide application alone will not control cockroaches satisfactorily.* Some specific actions that

will reduce harborage include:

- Seal as many cracks and crevices in the kitchen and food storage areas as possible with a good silicone sealer. A review of monthly reports may indicate from time to time that other specific areas may need to be sealed.
- Repair holes in walls or floors and seal inaccessible areas that could become harborages for pests.
- Replace wood food storage shelves with wire shelves.
- Do not store infrequently used items in the same areas as frequently used items and food supplies.
- Repair all moisture problems.
- Do not keep recycled goods such as beverage containers, cans, paper, cardboard, etc. near the kitchen or food supply areas.
- Institute a good cleaning program. *Pesticide use without cleaning and sanitation will not produce long term control of a pest infestation.*
- Recommend good lighting.
- Point out areas that need ventilation.
- Recommend reduction of clutter (particularly cardboard boxes) and excess product in cabinets or storage.
- Where practical, install air curtains to keep out flying insects.
- Recommend rotating stock.

Vacuuming as a Pest Control Method

A relatively new method of "cleaning out" a pest population is vacuuming. This is used to crash (greatly reduce) the cockroach population; it also removes dirt, food particles, etc. The "clean out" is followed by improved sanitation, pest prevention and, if needed, judicious use of pesticides. If vacuuming is used as a pest control method, be sure to use a vacuum cleaner with a HEPA (high efficiency particulate air) filter to avoid suspending materials in the air that can cause respiratory problems.

Pesticide Application

In attacking cockroaches, one should concentrate on monitoring the cockroach population and delivering pesticides into active harborage areas rather than "baseboard spraying."

- Many types of sticky traps are available to help the technician pinpoint sources of cockroach infestation. Sticky traps are *not* intended for control, but rather to detect infestations and to evaluate and target control measures. Place sticky traps behind kitchen appliances, in cabinets and supply rooms.
- Containerized and paste or gel baits should be the standard insecticide treatment for cockroaches in many buildings. The small, plastic bait containers should be placed as close as possible to harborage sites where the cockroaches are actually living. Place the bait stations behind refrigerators, in cabinets and along edges of walls and in corners. Do not place them where students can find them. The two most common mistakes in using containerized baits are (1) not eliminating nearby food sources and (2) not using enough bait stations. Paste and gel baits are most effective when applied in small dabs. Baits are most effective when the cockroach population is low or moderate in size. If there is a large population, the bait in the stations may be entirely eaten before the cockroaches are eliminated. *Bait stations should not be contaminated by sprays or dusts that may be repellant*
- When a moderate to large cockroach population is present, crack and crevice insecticide application is sometimes the most practical and effective way to apply insecticides. Use a narrow diameter extension tube in infested cracks and crevices to provide a thorough application of residual insecticide. (A crack and crevice treatment implies that the stream of insecticide is never visible during the spraying process.) Treat cracks and crevices under furniture, drawers, sinks, around pipes and in high cabinets. First remove utensils and supplies in cabinets; do not treat shelf surfaces.
- Space treatments should only be used to knock down a *heavy* cockroach infestation quickly so that other control measures can be used effectively. *The need for repeated fogging at short intervals indicates the cockroach population is rising, not decreasing.* Space treatments (fogs or aerosol applications) flush cockroaches out of harborage, causing them to cross residual pesticide applications, or the insecticide droplets land on the insects, killing them by direct contact. Such treatments lack crack and crevice penetration. Fog treatments should not be used in areas where facility staff are present. Prior to treatment, all exposed food and food contact surfaces should be effectively protected against pesticide contamination. After the application, food preparation surfaces should be cleaned before they are used for food preparation.

Follow-up

When a cockroach population has been controlled, the technician should continue to monitor the area with sticky traps and interview staff to detect cockroach problems before they become worse.

The ***Brown-banded Cockroach*** is less commonly a problem in buildings, but they also can build up large infestations where they find favorable harborage. Adult brown-banded cockroaches are the size of German cockroaches, about 1/2 inch long. The brown-banded cockroach has two transverse light bands near the head of the insect.

Behavior and Harborage
Brown-banded cockroaches, like German cockroaches, build up the highest populations in kitchens. However, their tendency is to increase in warm rooms. They can be common around high cabinets and areas near stoves and warm motors, such as those in refrigerators, electric clocks, light timers, televisions and radios.

- ***Control and Management***

Inspection
Inspection for the brown-banded cockroach is essentially the same as for German cockroaches. However, brown-banded cockroaches will be more scattered and less attracted to moisture.

Habitat and Harborage Reduction
Habitat and harborage reduction is essentially the same as for the German cockroach.

Pesticide Application
- Boric acid powders may be used in inaccessible areas. (Boric acid powders should NOT be over-applied so there is a visible residue.)
- Bait stations with a long active period are effective, but should not be contaminated by sprays or dusts that may be repellant. Place an adequate number in or near harborage. Do not use where students can find them.
- If baits do not control the cockroaches, use a crack and crevice application to provide a thorough application of residual insecticide: under furniture, drawers, sinks, around pipes and high cabinets. First remove utensils and supplies in cabinets; do not treat shelf surfaces.

Follow-up
The long egg hatching time of the brown-banded cockroach requires treatments to be monitored with sticky traps.

MANAGEMENT OF LARGE COCKROACHES

The ***Oriental Cockroach*** is often called the "waterbug." Adult oriental cockroaches are very dark-brown or shiny-black. The female is slightly longer than the male, about 1 1/4 inch to his 1 inch. Unlike other domestic cockroaches, the female does not develop wings, but produces only short triangular wing pads. The male has wings, but they are short and broad, leaving about 1/4 of the abdomen exposed.

Behavior and Harborage
Oriental cockroaches favor crawl spaces, spaces between the soil and building foundations, the undersides of stoops and sidewalks, landscaping mulches, water meters, basements and their floor drains and other such moist places. These cockroaches frequently live in floor drains that lead directly outside; these drains are also used as entrances to buildings. The oriental cockroach prefers starchy foods and may build up around garbage cans. They tolerate cooler temperatures, and they are usually found near humid areas.

- ***Control and Management***

Inspection
Search areas of high humidity, such as basements or areas near leaking pipes. Place sticky traps in basements to capture individual insects that may enter from floor drains.

Habitat Alteration
- Caulk all cracks around pipes and other areas where holes penetrate through ground level walls.
- Stop water leaks, screen equipment overflow drains and take overflow water away from buildings; keep drain traps full of water or capped.
- Remove rotting leaves from window wells.

- Replace mulch around the foundation with plastic porous ground cover and gravel.
- Move garbage cans away from wet areas.
- Stop erosion that causes soil voids around foundations.
- Ventilate moist enclosed spaces.

Pesticide Application

- Large bait stations or other baits are effective when properly placed in proper quantities. Particular attention must be paid to pesticide degradation due to moisture.
- If oriental cockroaches are entering from the outdoors, apply insecticides as outside barriers when they can be safely used in areas of known infestation. Use insecticide formulations that are not readily absorbed by porous surfaces (concrete floors, bricks, stones, soil, etc.). Apply them in cracks and crevices.

Follow-up

Numbers observed in the spring may appear low or under control but may build up by midsummer.

The ***American Cockroach***, like the oriental cockroach, is sometimes called the waterbug. Adult American cockroaches are large (1 1/3 to 1 1/2 inches) reddish-brown insects.

Behavior and Harborage

Large populations of American cockroaches live in warm moist habitats. They are most often found in boiler rooms or other harborage with water heaters, floor drains, water sumps and warm moist basements.

- ***Control and Management***

Inspection

Search areas that provide warmth and high humidity. Place sticky traps in areas where American cockroaches may enter a building.

Habitat Alteration

- Caulk cracks around plumbing and other penetrations in walls, screen equipment drains and floor drains. Keep drain traps full of water or cap them.
- Remove items stacked in attached garages, entry ways, etc.
- Replace mulch near doors and window wells with plastic porous ground cover and gravel.
- Ventilate humid places.

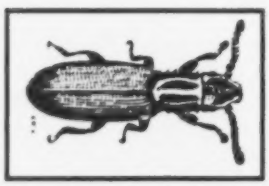
Pesticide Application

- Many of the methods that control the oriental cockroach will also control the American cockroach.
- If American cockroaches are entering from the outdoors, apply insecticides as outside barriers when they can be safely used in areas of known infestation. Use insecticide formulations that are not readily absorbed by porous surfaces (concrete floors, bricks, stones, soil, etc.). Apply them in cracks and crevices.

Follow-up

Ongoing monitoring with sticky traps is important due to the long life span of this cockroach.

Pantry Pests



Sawtooth Grain Beetle

Many kinds of moth larvae and beetles attack cereal products, flour and other dry foods derived from plants. Flour beetles, saw-toothed grain beetles and Indian meal moths are some of the more common ones. These insects can be found in opened packages or containers of grains or plant materials and in the cracks and crevices of cabinets or cupboards. In schools or other public buildings, infestations often originate by means of food packages brought into the structure. Sometimes they may even gain entrance to unopened packages. Because most pantry pests are capable of flying, they may enter buildings that way. Once inside the building, these insects will spread through other food and the infestation will increase.

Habits and Damage
The young (larvae) and some adults of these insects feed on grains (rice, barley, corn, wheat, and bird seed), grain products (oatmeal, cornmeal, pasta, breakfast cereals, flour, cake mixes, pancake flour, and dry pet food), nuts, dried fruits, and other dried plant materials (dried flower arrangements, ornamental corn, seed displays and pictures made with seeds). Several types of beetles (cigarette beetles and carpet beetles and relatives) also will feed on spices.

All life stages (egg, larva, pupa, adult) of these insects may be present simultaneously in infested products. The adult beetles and moths are frequently seen in cupboards, on counters and cabinets and around windows. Beetle infestations frequently can be identified by the old larval skins left in the stored product. Indian meal moth larvae spin webbing threads throughout and over the surface of the infested product and the mature larvae frequently leave their food source to complete development to the adult. These migrating larvae are usually noticed as they crawl in cupboards and across walls and ceilings.

Prevention
To help prevent infestations:
- Whenever possible, buy food in small quantities so that it will not be stored for a long period.
- If foods are kept for long periods (a month or more), remove them from their original containers and store them either in airtight glass, metal, or plastic containers or in the refrigerator.
- Caulk cracks and crevices where food debris could accumulate.
- Clean up any spillage in cabinets immediately and thoroughly.
- Give food storage cabinets a thorough cleaning at least once a year.

- ***Control and Management***

Inspection
Inspections for pantry pests are essentially the same as for small roaches. In addition, you should check all packages of cereal products.

Habitat and Harborage Reduction
Habitat and harborage reduction for pantry pests is essentially the same as for small roaches. Additionally, you should check all packages of cereal products *and discard infested materials*. Sanitation is the primary method of population reduction where infested stored products are found.

Pesticide Application
- If an infestation is difficult to eliminate, insecticides registered for use in the infested area should be carefully applied to cracks and crevices.
- Reinspect problem areas frequently.

Follow-up
Ongoing monitoring and inspection plans should be put into effect in all kitchens and food-storage areas. A complete pest management program is recommended for these operations. Clear communication with staff is important. Cleaning and sanitation procedures should be monitored constantly.

Ants

It is important to note that of the ants found indoors, only a few species are responsible for the majority of infestations. Identification of the ant helps the technician identify possible sites of the infestation. However, baits can be placed in infested areas while the technician is having the ants identified.

If ants are found in a building, an important first step is to determine whether the ants from a colony located ***inside*** or ***outside*** the structure.

*Indications that a colony is **inside** are when:*
- ant workers are consistently found inside over a long uninterrupted period
- nest building is observed inside (Look for wood shavings of carpenter ants, "dumping" of materials by ants, etc.)
- the colony is located in the upper floor of a building, or

- inside swarming is observed.

*Indications that a colony is **outside** are when*
- ants inside can be "trailed" outside
- ants outside can be seen coming inside
- nesting sites outside are near the structure with an inside infestation - look for mounds next to the foundation, or trees with large carpenter ant colonies touching an infested portion of the building or
- ants nest under slabs or swarm inside, but workers do not forage inside.

Whether the colony is inside or outdoors, ants that are known to tend aphids for the sweet liquid ("honeydew") that they produce often seek food inside before this food is available outdoors. After populations of aphids and similar insects increase (in late spring), ants may disappear. They may return in dry weather seeking moisture, but often will not be seen until the next spring. When pest control efforts occur during this period, it is often difficult to tell whether the pest management methods are effective or whether the ants left the building because of other food sources.

• ***Control and Management***

Inspection
- Get all information possible by talking to the staff.
- Observe ant worker movement and plot on a diagram if need be. Try to target "hot spots" of the infestation.
- Use traps baited with a grease and a sugar or syrup or other ingredients like peanut butter and cookie crumbs.

Inside - Inspect holes and cracks where workers enter, old or new moisture stains, food accumulations (such as bird seed or food for classroom pets), activity near appliances (dishwasher and washing machines), near showers, in drawers, adjacent rooms or rooms above and below activity.

Outside - Inspect for workers behind vines, shrubs, other plants near the building, expansion joints, slabs, patio blocks, bricks, boards, plant pots, under and inside wooden columns and pillars, outside door and window frames, window wells, where telephone wires and air-conditioning refrigerant pipes enter building walls, trees that harbor colonies and provide access to buildings by overhanging limbs that touch, water meters and storm drain inspection manholes. Outside of ground-level rooms, inspect plants for aphids being tended by ants.

Habitat and Harborage Reduction
- Caulk where pipes enter walls and seal masonry cracks. Check utility lines, air conditioning, refrigerant pipes, phone lines, etc.
- Tighten door and window frames.
- Repair water leaks.
- Trim vegetation so it does not touch the building.
- Remove items stacked close to buildings such as boards, stones, etc. that encourage ant nests; screen openings in hollow pillars, columns and ventilators

Pesticide Application
- Whenever possible, baits should be used to control ant colonies. Use baits with slow-acting stomach poisons or with insect growth regulators. Baits are excellent in sensitive areas, such as computer rooms. When using baits always remember that students will not leave baits alone if they know where they are located. *Do not spray or dust around baits - ants and other insects can detect tiny amounts of repellant chemicals.* Never store baits or bait materials where they can be contaminated with any other odors, especially fumes of pesticides.
- If the nest is located, use the "crack and crevice" treatment method; use dust in wall voids or canned pressurized liquid pesticides fitted with a tube for crack and crevice application. (Tubing can be obtained in long lengths and can be threaded through construction elements to treat areas distant from the pressurized can.)
- Apply wettable powder or microencapsulated spray formulations where pesticides may be absorbed into porous surfaces.
- Drill holes where practical into areas such as false floors in sink cabinets, window frames, wall panel grooves and other voids to deliver the pesticide where it is needed.
- Outdoors, use bait stations designed for outdoor use or insecticide granules labeled for control of ants outside.

Follow-up
Reinspect the facility or contact staff with troublesome ant control problems within one week to 10 days depending on the control strategies. If using insect growth regulators (IGRs), remember that IGRs take longer than dusts to show results. Remember, pesticide treatments can repel ants and make them active in other areas. Colonies with multiple queens may break up into several colonies.

Black Carpenter Ant

The large, black workers range in size from 1/4 inch to almost 1/2 inch. (Carpenter ants are usually entirely black, but some carpenter ants may be reddish-black.) Outside workers can be confused with field ants which do not enter structures. Workers will search for food 30 feet or more from the colony.

The colony may be found in wood (such as a fallen log, tree hole, stump or a structure wall). When carpenter ant workers dig nest tunnels, they chew out small pieces of wood. Unlike termites, they do not eat the wood; they drop it out of the nest area or pile it in one place. This pile of carpenter ant shavings, called sawdust, is very soft and is made up of pieces like a fine chisel would make. (Gritty construction sawdust in attics or on sills can be left over from construction or repairs and may be mistaken for carpenter ant shavings.) Carpenter ants do not put mud into their tunnels like termites; carpenter ant tunnels have very smooth sides. A nest or colony might harbor several thousand ants. Large colonies of carpenter ants can cause structural damage, but the colony more likely will be found partially in structural wood and partially in void spaces (such as between roof boards, between studs under windows or between subflooring and shower bases).

Black carpenter ant workers forage for sweet foods (such as honeydew from aphids and juices from ripe fruit) and insects. Indoors, they like sweets, meats, fruit juices and moist kitchen refuse.

- ***Control and Management***

Inspection
A thorough inspection is critical to successful control of carpenter ants. It is important to discover whether carpenter ants are nesting inside or outside. If ants are nesting inside:

- their presence usually indicates a moisture problem in the building and
- they have excavated tunnels (galleries) for harborage in structural wood.

Carpenter ants are often found near a roof leak or other damp wood. In many cases, Carpenter ants make their nests in wood that has been wet and infested by a brown rot fungus. Dark fungus stains on the wood is an indication of the presence of such moisture. Moisture in wood can be caused by

- improper attachment of wooden additions, dormers and hollow wooden columns that absorb moisture
- porch floors, door sills, down spouts or areas where water collects or drains toward the building
- regular gutter overflow pouring rainwater down the side of the building as well as back onto roof boards and soffits, etc.
- leaking roof valleys
- improper flashing, especially around chimneys, vents and skylights
- improper roofing or holes in the roof
- window sills directly exposed to rain, or
- lack of ventilation in any area where moisture accumulates, such as around any leaking plumbing or drains (especially shower drains), unvented attics and crawl spaces, or unvented dishwashers, washing machines, ice machines, etc.

Carpenter Ant Worker

The many nesting sites, foraging entrances and food and moisture sources offer clues for inspection and location of the nest. The area where the majority of ant activity is seen may identify a nest site if entry from the outside can be ruled out. Carpenter ants are more active at night, so inspecting the area with the aid of a flashlight may be helpful.

Habitat and Harborage Reduction

- Where nests are located inside, remove and replace infested structural wood.
- Repair or seal areas where moisture dampens wood.

- Wherever possible, caulk and screen area where ants can enter the building.
- Ventilate indoor spaces where moisture accumulates, grade soil so water drains away from the building where necessary and repair roofing, guttering etc.
- Trim trees where branches touch a structure or overhang roofs.

Pesticide Application

Eliminating colonies and nesting sites is a primary way to eliminate carpenter ant infestation.

- Place baits in areas where foraging ants can discover them. *Carpenter ants are more difficult to control with baits than other species.* Place baits in areas inaccessible to students.
- Remember to use enough bait stations to control the colony.
- Use pesticidal dust or pressurized canned aerosols when nests are found in wall voids. Sprays are less effective.
- Avoid using flushing agents because hundreds of ants may remain unaffected and can relocate the colony in a matter of hours or less to trunks, storage boxes, furniture drawers and other voids.
- Aphids or other honeydew producing insects should be treated with pesticides, such as oils or soaps, that will not eliminate beneficial predators and parasites.
- If a tree with rotted areas is present, one should contact a professional who can determine if it should be removed.

Follow-up

Carpenter ant infestations often cannot be controlled in one visit. Thorough inspection is needed to make management effective. Monthly inspections also assure that necessary repairs have been made.

Pavement Ant

The Pavement ant is brown or black and about 1/8 inch long. Pavement ants nest outside under rocks, at the edge of pavement, door stoops and patios. They commonly move their colonies inside between the foundation and sill plate. Outside, pavement ants tend honeydew-producing insects and feed on other insects and seeds.

Pavement ants store debris in certain areas of the colony or nest. When this area is needed to enlarge the nest, workers remove materials such as sand, seed coats, dead insect parts and sawdust from the building construction and dump them outside the colony. Colonies located on foundation walls drop debris over the side in a pile on the basement floor.

- ***Control and Management***

Inspection

- Inspect along the sill plate in the basement and around heat ducts and baseboards in areas where ant workers are active.
- Look for foraging in the kitchen; such activity may indicate a nest in the basement below or just outside.
- Outside, look for tiny mounds next to the building near windows and doors or nest openings under stones.

Habitat and Harborage Reduction

- If ants are a chronic problem in the building, remove stones that shelter ant colonies.
- Improve indoor sanitation, including the elimination of moist garbage in dry weather.
- Caulk observed ant entrance points.

Pesticide Application

Inside:

- Place baits in areas where foraging ants can discover them. *Always* place baits in areas that are inaccessible to students.
- If baits do not eliminate the colony, apply dusts or sprays in cracks and crevices of baseboard molding where activity is noticed. ***Continue to search for the nest.***
- Treat cracks around kitchen sinks and cabinets.
- Treat cracks along foundation walls, under sill plates and cracks near heat ducts.
- Be careful not to contaminate heat or air-conditioning ducts.
- Treat cracks in slab foundations as well as the base of outside door jambs.

Outside:

- If baits applied inside fail to control the colony, treat nests.

- Treat cracks and entry points.

Follow-up
Follow-up is usually not needed, but where control is unsuccessful, an intense inspection is required.

Odorous House Ant

The odorous house ant is brownish-gray in color and around 1/8 inch long. The body of the odorous house ant is relatively soft and can be easily crushed. When this occurs, a foul odor is released. Outdoor nests are shallow and are located under stones and boards. Inside, a colony can nest in many types of cavities. The workers trail each other. Outside they actively tend honeydew-producing insects and take flower nectar. Inside, workers seem to prefer sweets.

- ***Control and Management***

Inspection
- Begin by investigating locations where ant activity is observed.
- Always inspect outside close to the location of inside activity. Look under stones and boards for colony openings and activity.
- Do not use sprays with pyrethrins (which irritate but may not kill), causing the colony to split itself and relocate, as with the pharaoh ant.

Habitat and Harborage Reduction
- Remove stones and boards harboring odorous house ant colonies.

Pesticide Application
- Bait stations with a long active period are effective, but should not be contaminated by sprays or dusts that may be repellant. Place an adequate number in or near harborage. *Always* place baits in areas inaccessible to students.
- If baits do not eliminate the colony, use dusts or residual sprays applied in cracks and crevices in the area of entering worker trails. Ant colonies should be sought outside as well as inside, unless its location inside prevents its reaching the outside.
- Control populations of honeydew-producing insects on plants near the building. Use pesticides registered for insects on plants. To maintain predator and parasites of these plant insects, use low-toxicity pesticides such as insecticide soaps and oils.

Follow-up
Impress the staff with the need to control honeydew insects on plants and to eliminate nest harborage near structures.

Pharaoh Ant

The pharaoh ant is a tiny ant, dull-yellowish to light-orange in color and not much more than 1/16 inch long. Ants prefer warmer buildings and warm areas (80-85° F.) in buildings for nesting. These ants are active year-round in large buildings. Nesting sites include wall voids, cracks in woodwork, stacks of paper, envelopes, harborage in desk drawers, etc. It is common to find many colonies in one building and, perhaps, several in one room. Colonies have multiple queens and increase by dividing: one portion of the colony going with each queen. No swarms have been recorded, so new infestations are apparently transferred by moving infested objects.

Pharaoh ants trail each other and are attracted to grease, meats, insects and sweets. These harborage and food preferences bring it to coffee areas, kitchens, paper and other supply storage, office equipment, medical storage, laboratory benches and many kinds of biological cultures.

- ***Control and Management***

Inspection
- Inspect where sanitation needs improvement.
- Ants are found where food is available, particularly sugars: where coffee is made, lunches eaten and in desks where snacks are stored.

- Inspect storage room spills, laboratory media, unwashed cups, areas near vending machines and kitchens.
- Pharaoh ants are easily baited. Use small, nontoxic disposable peanut butter baited cups to demonstrate where ants are seen (such as desk drawers and opened food boxes).
- Look at sources of water. These ants are attracted to dripping faucets; they drown in plant water bottles and coffee water held overnight. Floating ants are frequently the first sign that these ants are present.

Habitat and Harborage Reduction

- Reduce stored supplies.
- Clean, rearrange and rotate supplies to expose nests.
- Clean food areas before the end of the work day and empty water containers that stand overnight.

Pesticide Application

- *Spraying can cause pharaoh ant colonies to break up into several smaller colonies and spread the infestation; baits are the most effective way to control these ants.* Several baits are available for pharaoh ant control. Place a bait station where every positive monitoring trap was located. *Always* place baits in areas that are inaccessible to students.
- Set commercial bait stations. One that uses a stomach poison well accepted by ants and a grain-based bait that includes ground insects are specifically manufactured for pharaoh ant control.
- Use a commercial bait of mint apple jelly and boric acid. Inject small dabs of the material into cracks and crevices where ants are observed.

Follow-up

Reinspect by monitoring bait cups. When sprays or dusts are used, or when colonies are disturbed by inspection or habitat alteration, colonies may move or split.

Spiders

Although fear of spiders is common, poisonous types are not likely to be encountered in most public or commercial buildings. However, the brown recluse spider has been found in schools, particularly in the southern part of Illinois. Harmless, crawling spiders are occasionally a nuisance in basements or other areas. Tighter sealing around windows and utility access holes and tight weatherstripping on exterior doors will usually reduce their numbers. Residual insecticide sprayed on surfaces near potential entry may help somewhat; dust and microencapsulated formulations may have a greater chance for success. Spiders that build webs in secluded corners or in outdoor locations such as eaves or lights can be most efficiently controlled with a vacuum. The general approach of sealing up entry points and vacuuming up intruders should be the first consideration for most types of spiders (and other miscellaneous crawling pests, such as crickets and millipedes).

Wandering Spiders

Spiders will enter buildings in search of food and shelter. Below is a list of spiders that are often found in or around buildings. Although most spiders can bite, the injury from this group is similar to a bee sting.

Wolf Spider

The hairy, fleet, wolf spiders are very common outdoors under leaf litter, rocks and logs. When they come inside, they normally stay on the ground floor and are active in dim light. Large wolf spiders often frighten people. If handled, they give a painful bite, but it is not dangerous.

Jumping Spider

Jumping spiders are active during the day and are common around windows where they feed on insects attracted to natural light. Jumping spiders are usually small, up to 1/2 inch in length and many are brightly colored. They move in quick rushes, jerks or jumps. They often enter buildings from shrubs near windows or ride in on plant blossoms.

Crab Spider

Small crab spiders are dark or tan; some are lightly colored orange, yellow or creamy white. Their legs extend out from their sides causing them to scuttle back and forth in a crab-like fashion. These spiders hide in flower blossoms and may be brought inside in cut flowers.

- ***Control and Management***

If called on to eliminate wandering spiders, the best action is to locate specimens, identify them, assure staff that they are not poisonous and tell staff how they got inside.

- Tighten door thresholds and around window screens.
- Caulk door and window frames and all wall penetrations.
- Remove vegetation and litter from the foundation, doorways and window wells.
- Where possible, relocate building or area lights that attract flying insects, especially midges.
- Advise staff to look carefully at flowers brought in from the garden and from commercial greenhouses.
- Assure staff that they can swat or vacuum spiders without harm.

Pesticide application is very difficult; indoor treatment is usually effective only if the pesticide contacts the spider directly. This means the technician must have access to all spider habitats. Unless efforts are made to exclude spiders (such as tightening gaps around entrances and inspecting where materials are being brought into the facility), spiders will reenter.

Brown Recluse Spider

The brown recluse spider is uniformly tan to brown without markings except for a dark fiddle-shaped mark. Although they can be found living outdoors in southern Illinois, they can be introduced into buildings in other areas of the state where they have been transported in boxes, pallets or other items. The brown recluse makes a fine, irregular web. It commonly wanders in the evening in indoor infestations.

Brown Recluse Spider

Bites- Brown recluse spiders avoid busy parts of rooms where people are present, remaining where there is no activity and in closed or unused rooms. Even though indoor infestations can be large, people are seldom bitten. Bites may occur when rooms are suddenly put into use or when stored clothing is brought out for use. Brown recluse bites are sharp but not initially painful, but a blister is quickly raised, broken and surrounded by a red welt. The depressed center of this raised, red circle (the size of a dime to a quarter) turns dark within a day. The dead tissue often falls away and the bite area scars over in one to eight weeks. Death seldom occurs, but the bite can result in a large and disfiguring scar.

The spider is delicate. After biting, it frequently can be found lying where it was slapped by the victim. It should be killed and taken to the physician along with the victim for positive identification. Other biting or stinging insects (and related creatures) can produce injuries resembling the bite of the brown recluse spider. *Consequently, some cases of "brown recluse spider bites" are actually injuries from other causes. Before any pesticide application occurs, a thorough inspection for the brown recluse spider should be conducted.*

- ***Control and Management***

Inspection

- Sticky traps are very useful in determining if brown recluse spiders are present.
- Look along walls in uninhabited rooms, under and behind furniture, in the far reaches of storerooms, in unused closets, under stairs and in hanging clothes that have not been used during the current season.
- Concentrate on areas outside daily human traffic patterns. Buildings that have been unoccupied for months or longer are particularly susceptible to increased spider populations.
- Outdoors, in southern Illinois, these spiders may be found in cracks between the soil and structure foundations, door stoops and in window wells.

Habitat and Harborage Reduction

- Recommend careful mopping or dusting of seldom-used rooms and closets.
- Inspect clothing (such as that used in plays) that has hung in hallways or unused closets through the summer. Store them in plastic bags.
- In the evening, reinspect spaces disturbed by dusting and mopping. Kill moving spiders.

Pesticide Application

- Carefully use residual pesticides labeled for spiders. Dusts and microencapsulated insecticides are usually more effective than other formulations.
- Apply the pesticide in all cracks and crevices -- particularly in spaces outside daily human traffic patterns. Spot treatments will be less effective than crack and crevice treatments because spiders touch spot residues only with hairs at the tips of their legs.

Follow up

Spiders not killed by the pesticide treatment will wander. Warn staff to be wary when picking up items in rooms not normally in use. They should watch carefully for spiders one or two days following treatment. Monitor and, if indicated, retreat the structure in one or two weeks. Infestations of the brown recluse spider may be difficult to eliminate completely; continue to monitor infested areas with sticky traps for several months.

Yellowjacket Wasps

Yellowjacket wasps (often mistakenly identified as "bees") may become a nuisance around buildings. From August through October, when yellowjackets have built up large populations, they seek food such as carbonated beverages, cider, juices, ripe fruits and vegetables, candy, ice cream, fish, ham, hamburgers, hot dogs at picnics and other outdoor events. Many are attracted in large numbers to garbage cans. Others fly in and out of nests built around buildings and areas where people live, work and play, causing fear and alarm. Although yellowjackets are considered quite beneficial to agriculture since they feed on harmful flies and caterpillars, it is their aggressiveness and painful stinging ability that cause most concern. Nevertheless, unless the threat of stings and nest location present a hazard, it may be best to wait for freezing temperatures in late November and December, to kill off the colony. Stinging workers do not survive the winter and the same nest is not reused.

German Yellowjacket

The German yellowjacket is distributed throughout the northeastern quarter of the United States and often nests in wall voids and other cavities. (Other yellowjackets usually nest in the ground.) Nests in attics and wall voids are large and workers can chew through ceilings and walls into adjacent rooms. The nest of the German yellowjacket is made of strong light gray paper. Colonies of the German yellowjacket may be active in protected wall voids into November and December when outside temperatures are not severe.

Yellowjacket Wasp

Problems with yellowjackets occur mainly when:

- humans step on or jar a colony entrance
- a colony has infested a wall void or attic and has either chewed through the wall into the building or the entrance hole is located in a place that threatens occupants as they enter or leave the building or
- in the late summer months, they search for sweet liquids like ripe, fallen fruit, soft drinks and sweets at picnics, sporting events and other gatherings.

Yellowjackets are sometimes responsible for an infection following a sting. A contaminated stinger can inject the bacteria beneath the victim's skin. Blood poisoning should be kept in mind when yellowjacket stings are encountered.

- ***Control and Management***

Inspection

Sting victims often can identify the location of yellowjacket nests. Soil nests are often located under shrubs, logs, piles of rocks and other protected sites. Entrance holes sometimes have bare earth around them. Entrance holes in structures are usually marked by fast-flying workers entering and leaving. A nest high in a tree should not be a problem unless it is where it may be disturbed. *Be sure to wear a bee suit or tape trouser cuffs tight to shoes.*

Habitat and Harborage Reduction

Management of outdoor food sources is very important.

- Clean garbage cans regularly and fit them with tight lids.
- Remove trash that includes bakery sweets, soft drink cans, candy wrappers and other food waste several times a day

from outdoors trash bins during periods of yellowjacket activity.
- Where possible, locate food stands away from dense crowds during the late summer.
- Clean drink dispensing machines; screen food dispensing stations and locate trash cans *away* from food dispensing windows.
- To limit yellowjacket infestations in wall voids and attics, keep holes and entry spaces in siding caulked; screen ventilation openings.
- If yellow jackets are entering rooms through windows, window screens should be installed in windows whenever possible.

Pesticide Application

When possible, treat after dark; workers are in the nest at that time. *If nests are located high in a structure where there may be a danger from falls or electrical wires, maintenance staff who also do pest control may be wise to hire a professional pest control contractor to treat the nest.*

Begin with the entrance hole in view and a good plan in mind.
- Wear a protective bee suit. Unless these insects can hold on with their claws, they cannot get the leverage to sting. Bee suits are made with smooth rip-stop nylon which does not allow wasps and bees to hold on. A bee veil and gloves are part of the uniform. Tape or tie off wrist and ankle cuffs to keep the insects out of sleeves and pant legs.
- Move slowly and with caution. Quick movements will be met with aggressive behavior. Move cautiously to prevent stumbling or falling onto the colony.
- Have equipment handy so one trip will suffice.

Application to Underground Nests
- Insert the plastic extension tube from a pressurized liquid spray or aerosol generator in the entrance hole; release the pesticide as indicated on the label.
- If the pressurized liquid spray includes chemicals that rapidly lower nest temperature (freeze products), be aware that it will damage shrubbery.
- Plug the entrance hole with steel wool or copper gauze and dust the plug and area immediately around the entrance with insecticide. Returning yellowjackets will land at the entrance and pull at the plug picking up dust. Any still alive inside will also work at the dusted plug.

Application to Wall Voids
- Be especially cautious when using ladders to get at wall void nests. Set the ladder carefully and move slowly.
- Approach the entrance hole cautiously; stay out of the normal flight pattern.
- Watch first. Observe whether yellowjackets entering the nest go straight in or to one side or the other.
- Insert the narrow diameter plastic tube in the hole in the observed direction of the entrance and release pesticide as indicated on the label.
- Dust inside the entrance and plug it as with underground nests.
- Remember, German yellowjacket nests may remain active into December.
- Use care not to contaminate food surfaces.

Control of yellowjackets with traps has not been effective with eastern species. Spraying trash cans and the outside of food stands will reduce or repel yellowjackets at sporting events; the treatment will not last long. Remember, do not contaminate food surfaces.

Follow-up

Ongoing monitoring throughout the active yellowjacket season is essential when a pest management program is in place at locations where there are outdoor activities. Whenever possible, screens should be installed in school room windows and garbage cans should have tightly-sealing lids.

Termite and Ant Swarms

Termite Swarms

Most people are familiar with the extensive destruction that termites can cause to wooden structures. Termites can also damage structural wood in steel and concrete buildings, such as trim or molding, paneling, furring strips, or door and window frames. Stored files, stacked books, or any other cellulose-based material (such as fiberboard sheathing or insulation panels) may also be attacked.

Most termite problems in large buildings involve subterranean colonies that persist for years on buried scrap wood and constantly explore upwards for new sources of food. These colonies are often a nuisance not because of the actual damage they cause, but because large numbers of winged "swarmers" periodically find their way into occupied space. Although extremely disruptive, swarmers are harmless, cannot bite or carry disease and cannot damage interior wood. Swarming termites should be controlled with a vacuum rather than a space spray, but spraying may be unavoidable in rare circumstances. The presence of swarming termites should be followed with a termite inspection by a professional pest control company.

Ant Swarms

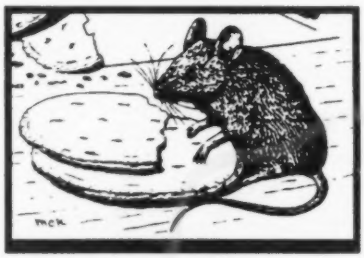
Many types of ants produce winged queens and males at certain times of the year. Large numbers of these "swarmers" may pour out of crevices into a room, even in locations that never had a problem with crawling ants. Swarming ant reproductives are sometimes confused with termite swarmers (Appendix II). Swarming ants can severely disrupt operations and often result in occupant demands for spraying. In cases where the ants are relatively concentrated (such as at windows), the recommended procedure is to vacuum them up and dispose of the contents in an outdoor trash bin.

However, in some cases, control with an insecticide may be the only practical response. Winged ants emerging inside a building usually die or disperse quickly, so spraying tends to be of little value if not done immediately. Rooms should be unoccupied during a space spray treatment, all electronic equipment should be well covered and the space should be ventilated for at least several hours before reoccupation. Location of the ants' entry points (and the nest itself, if possible), injection of pesticide into these crevices and sealing up afterwards are the standard measures to prevent future swarming.

House Mouse

The house mouse is the most successful rodent in adapting to life with people. It's found almost everywhere people are, feeding on human food, sheltering in human structures and reproducing at a rapid rate. The house mouse is the most troublesome and economically important vertebrate pest, contaminating millions of dollars worth of food, damaging property and causing electrical fires with its constant gnawing. Mice may enter a building from the outside and spread through a structure along pipes, cables and ducts. Although large numbers can build up in food service areas or trash rooms, one or a few mice can survive practically anywhere.

Many control failures against house mice are due to a lack of understanding of mouse biology and habits. A pair of mice can produce 50 offspring in one year. Because they seek food over a range of only 10 to 30 feet, traps, glue boards and bait must be placed close to the nest to be effective. *Remember that good inspections are critical for successful mouse control.*



House Mouse

Inspection

Sounds - Sounds are common at night where large numbers of mice are present; listen for squeaks, scrambling and sounds of gnawing.

Droppings - A house mouse produces many droppings per day; mouse droppings are frequently the first evidence that mice are present. However, be aware that large cockroaches and bats may produce droppings similar to house mice. Look along runways, by food near shelters and in other places mice may frequent.

Urine - House mice occasionally make small mounds known as "urinating pillars." These consist of a combination of grease, urine and dirt and may become quite conspicuous. Look for many small drops of urine using a blacklight. Urine stains will fluoresce under ultraviolet light. (Mouse urine spots are not as easy to detect as those made by rats.)

Grease marks - Like rats, mice produce greasy smears where dirt and oil from their fur mark pipes and beams.

Runways - Most mouse runways are indistinct trails free of dust and are not readily detectable.

Tracks - Look for footprints or tail marks on dusty surfaces or on mud; use a nontoxic tracking dust (like talc) to help locate mice within buildings.

Gnawing damage - Newly-gnawed areas on wood are light in color, turning darker with age. Look for small tooth marks and enlarged cracks beneath doors. Mice make wood chips with a consistency like coarse sawdust around baseboards, doors, basement windows and frames and kitchen cabinets.

Visual sightings - Mice are often active in daylight and this may not indicate a high population (as it does with rats). Use a powerful flashlight or spotlight at night to confirm mouse presence.

Nest Sites - Inspect garages, attics, basements, closets and other storage places for evidence of nests. Be alert to fine shredded paper or similar materials; these are common nest-building materials.

Mouse Odors - Mice produce a characteristic musky odor.

Estimating Numbers of Mice - The number of mice observed or food consumed is not reliable as a census technique with mice. Unlike rats (which may travel widely within a building leaving tracks on many patches of dust) mice do not range widely.

- Read natural signs such as droppings, urine stains, tracks and damage.
- Make nontoxic tracking patches of talc at 20- to 30-foot intervals throughout a building. The more tracks seen in each patch and the more patches showing tracks, the larger the population is. The percentage of patches showing tracks will reflect the extent of the local infestation.
- Tracking patches are also an excellent means to evaluate a control operation. Compare the number of tracks or patches with mouse tracks before and after a control program.

- ***Control and Management***

Control and prevention of mice is a three-part process, which includes sanitation, mouse-proofing and population reduction with traps or baits. Sanitation and mouse-proofing will help prevent mice from entering buildings. When a mouse population already exists, some kind of lethal control is necessary. Otherwise, mice, which reproduce rapidly and can find food almost anywhere, will continue to be a problem.

Habitat and Harborage Reduction

Sanitation - Good sanitation makes it easier to detect signs of mouse infestation. It also increases the effectiveness of baits and traps by reducing available food. However, the best sanitation will not eliminate mice; they require very little space and small amounts of food to survive and reproduce.

- Store bulk foods in mouse-proof containers or rooms. In storerooms, stack packaged foods in orderly rows on pallets so that they can be inspected easily. A family of mice can live in a pallet of food without ever having to leave the immediate area.
- Keep stored materials away from walls and off the floor. A 12-18 inch yellow or white painted band next to the wall in storage areas permits easier detection of mouse droppings. This band and the areas around pallets should be swept often so that new droppings can be detected quickly.

Mouse-Proofing - Completely mouse-proofing a building is difficult because mice are reported to be able to squeeze through an opening as little as 1/4 inch high. To mouse-proof a building:

- Seal large holes to limit the movement of mice into and through a building.
- Plug holes in foundation walls with steel wool or copper mesh.
- Caulk and fit doors and windows tightly.
- Seal holes around pipes, utility lines, vents, etc., to make it difficult for mice to move in and out of wall and ceiling voids. (This limits mice to a smaller area and may make snap traps and glue boards more effective.)
- Do not prop open kitchen doors; install screen doors wherever possible.

Traps

Snap Traps. If used correctly, snap traps are very effective in controlling mice. They must be set in the right places, in high numbers and in the right position or mice will miss them entirely. *Always* place traps in areas that are inaccessible to students. Here are some tips to keep in mind when trapping mice:

- *Remember that mice rarely go further than 30 feet from the nest, only 10 feet in most cases.* If mice are sighted throughout a building, it means that there are many locations where you will have to set traps. Place snap traps not only wherever you see obvious signs of mice, but also in a three-dimensional sphere about ten feet in diameter around those signs. (Mice are good climbers.)

- Mice can be living above their main food supply in suspended ceilings, attics, inside vertical pipe runs and on top of walk-in coolers. Or they can be below, in floor voids, crawl spaces, or under coolers or other equipment.
- The best sites are those with large numbers of droppings since that means the mice are spending a lot of time there. Other good sites are along walls, behind objects, and in dark corners, particularly where runways narrow down, funneling the mice into a limited area.
- Successful trapping requires good mouse baits. Peanut butter, bacon, cereal and nuts are attractive to mice. Food baits must be fresh to be effective. Another bait is a cotton ball, which the female mice like to use for nest material. It must be tied securely to the trigger.
- Two or more traps placed next to each other will capture more mice than single traps.
- Probably the biggest mistake made in mouse trapping *is not using enough traps*. Use enough to quickly eliminate the mice.
- Great care must be taken to place traps out of the public view and to check them regularly.
- Mice can carry several diseases, so technicians should wash their hands after handling traps or other items that come in contact with mouse urine and feces. Use disposable latex gloves or tongs to handle dead mice. A bleach/water solution of at least three tablespoons household beach per gallon can be used to sanitize traps.

Multiple-Catch Traps. Multiple-catch mouse traps catch up to 15 mice without being reset. Some brands are called "windup" traps; the windup mechanism kicks mice into the trap. Others use a treadle door. Live mice must be humanely killed.

Mice are curious and like to investigate new things. They enter the small entrance hole in the trap without hesitation. Odor plays a role too; traps that smell "mousy" catch more mice. Place a small dab of peanut butter inside the tunnel entrance to improve the catch.

- Mice are captured alive but may die in a day or two; dead mice may cause odors or attract insects. Some traps have a clear plastic end plate or lid so you can see if any have been captured.
- Check traps frequently; mice can get hung up in the mechanism and render the trap inoperative.
- Place the traps directly against a wall or object with the opening parallel to the runway, or point the tunnel hole toward the wall, leaving one or two inches of space between the trap and the wall.
- If mice are active, place many traps 6-10 feet apart. After the mouse infestation is eliminated, *maintenance traps* may be placed where mice have been numerous before. Additionally, traps can also be placed at potential entry points such as storerooms, loading docks, near utility lines and at doorways.

Glue Boards. Glue boards can be effective when other methods have failed against a "bait-shy" mouse or when food is abundant. As with other traps, placement is the key. Locations that are good for other types of traps are good sites for glue boards.

- Place glue boards in hidden locations away from areas where staff can view them. (One method is to place the glue board inside a tamper-resistant bait station.)
- Use the larger "rat-size" glue boards, which are more difficult for mice to escape from.
- Do not put glue boards directly above food products or in food preparation areas.
- Set glue boards lengthwise and flush against a wall, box, or other object that edges a runway.
- Move objects around; create new, narrow runways six inches wide to increase the effectiveness of glue boards.
- Put peanut butter or a cotton ball in the center of the board.
- Place the glue boards 5 to 10 feet apart in infested areas (closer if the population is large).
- If no mice are captured in three days, move the boards to new locations.
- If a trapped mouse is alive, kill it humanely before disposal. Replace the boards if they become covered with dust. Glue boards do not work well in cold areas.

Rodenticides

"Building out" mice and trapping are the most effective control methods. Rodent baits should be used only in emergency situations to supplement these methods. If there is a repeated need to use baits, it is likely that sanitation and mouse-proofing should be improved. Remember that rodent baits are poisons. Additionally, use of baits in schools represents special problems because of incidents where students have moved or tampered with rodent baits. In schools, baits should be used only after nonchemical control measures have been instituted.

Children, pets, wildlife and domestic animals must be protected by putting the bait in tamper-resistant bait boxes in inaccessible locations. *Using baits alone will not provide long-term control of mice.*

- Apply bait at several locations rather than relying on a few large placements.

- Use *fresh* baits labeled for mouse control. (*Never store baits with other pesticides; mice can detect tiny amounts of repellant chemicals that may cause mice to reject the bait.*)
- Place the baits in favorite feeding and nesting sites as determined by large numbers of droppings.
- Place the baits between hiding places and food, up against a wall or object to intercept the mice.
- Make bait placements 10 feet apart or closer in infested areas if they can be adequately secured.
- If bait is refused, try switching to a different type and replace the baits often.
- Use small bait stations which are more attractive to mice than the larger rat-type stations.
- Make sure that sanitation is such that no other food is readily available to mice.

Head Lice

Adult head lice are about 1/8 inch long. Hatching occurs 7 to 10 days after attachment. Since lice go through a gradual metamorphosis, the tiny nymphs resemble adults. They grow to maturity in about 10 days.

Lice live on the scalp. They are able to crawl on the scalp between hairs with more speed than may be expected. Head lice suck blood painlessly by piercing the skin with sharp, needle-like mouth parts. Head lice neatly glue their eggs (called nits) to the hair shaft. The tiny, pearl-like eggs stick on to the hair so tightly that they can be dislodged only by being torn from the hair shaft by fingernails or a fine-toothed comb. *Nits found within ¼ inch of the scalp indicate an active infestation.*

Head lice spread from host to host through direct physical contact with an infested individual or by indirect contact such as sharing a comb, brush, hat or hair accessory with an infested individual or by storing a coat or hat infested with one or more head lice together with coats or hats of other persons. Transmission of lice is most common among siblings that have their hair brushed with a "family brush" or children who use hats and brushes of friends. Louse infestations are often discovered by school teachers who are watching for the signs of itching heads. However, classroom neighbors are not as likely to be infested as are brothers and sisters or close friends that sleep over or share brushes.

Head Louse

- ***Control and Management***

Several over-the-counter and prescription preparations are used to eliminate head louse infestations. *Advise clients to contact health or medical personnel for recommendations concerning insecticidal shampoos and other preventative measures for the home.* Advice regarding treatment of bacterial infections that can result from intense scratching during extensive infestations should be made by health care professionals.

In public areas, advise staff to:

- Vacuum all surfaces where children lie or play (including stuffed toys). In kindergartens don't forget to wipe or vacuum napping mats.
- Vacuum car interiors and wash car seat pads.
- Clean rugs or simply roll them up for 10 days after vacuuming.
- Remember, *do not* apply pesticides to rooms, toys or furniture surfaces.

Reported louse infestations should be investigated by an individual trained to perform head lice examinations. If live lice are not seen, the placement of nits on the hair shafts within ¼ inch of the scalp can serve to indicate a current infestation.

"Mystery Bugs"

Pinprick-like biting sensations, usually on exposed skin and often producing inflammations that resemble insect bites, can be a persistent problem in some buildings. Occupants tend to blame these "bites" on some sort of pest infestation, typically fleas (which are rare in schools or office buildings), or "paper mites" (which do not exist). Demands for spraying of the affected space are often carried out in the absence of any evidence that biting insects are present. In fact, "paper mites" are almost always tiny, irritating particles like paper shards that constitute a cleaning or indoor air pollution problem rather than a pest problem.

The Role of Management
The most common mistake of management in "paper mite" situations is to automatically request a pesticide treatment, thereby incurring liability in the event occupants experience adverse reactions to the chemical. The second most common mistake is for supervisors to dismiss the complaints of biting as imagination. Although there are cases where people imagine they are being attacked by unseen parasites, most instances of biting-like sensations in buildings involve a genuine source of skin irritation. The circumstances can be further complicated, because health care professionals unfamiliar with the "paper mite syndrome" frequently misdiagnose the resulting welts as insect bites. Other people may believe that microscopic dust mites are involved; dust mites are real, but they cause breathing distress rather than bites. Finally, it is normal for the coworkers of a person complaining about "paper mites" to develop a heightened sensitivity to their own skin irritations (many caused away from the workplace) through the "power of suggestion." *Management must treat all concerned with sympathy and respect, at the same time emphasizing that no pesticide treatment can be authorized without positive confirmation that a pest problem exists.*

- ***Control and Management***

Inspection for Parasites
An inspection of the affected area should be carried out by a pest control technician who understands that pests may not be involved. Usually when real parasites are present, many are present and are readily seen. The most common types in buildings are mites coming from bird nests or from rodent infestations. If a thorough investigation fails to produce any specimens, a non-pest cause is probably responsible. However, it is standard procedure to place sticky traps throughout the area as monitors. In addition, occupants should be instructed to capture anything they suspect is biting them on a piece of clear tape. If biting insects such as fleas are present, the area may need to be treated. However, the captured items are typically bits of debris or tiny, harmless insects that are usually present inside buildings as a result of inadequately filtered air intakes.

Inspection for Airborne Particles
When it is reasonably certain that there are no biting insects in the affected space, the pest control program is no longer involved. Only rarely are the specific culprits in "paper mite" cases positively determined, although there are often strong suspects. Shards of fiber glass insulation (such as from batting above drop ceilings), particles from both newly installed as well as worn carpet and carpet pads and paper dust from separating forms and computer printouts along tear-lines are some of the most common proven causes of pinprick-like irritations. The dry air of many workplaces not only makes skin more sensitive to these tiny splinters, it increases the static electricity that is responsible for the particles "jumping" onto exposed skin. (Sometimes the static-charged bits are mistaken for living bugs.) Any activity that stirs up accumulated dust, such as building remodeling, renovation or the purging of old files, often leads to a "paper mite" outbreak. In cases where there is no obvious explanation, or multiple factors are suspected, an industrial hygienist should be called in to investigate.

Corrective Action
Sometimes pesticide spraying or fogging brings temporary relief to occupants with a "paper mite" problem. Although part of the reason is psychological, the main reason is that *the spray acts to settle the irritating particles and to decrease static in the room.* Although it is questionable and misleading to use pesticides in this fashion, the same principle can be accomplished by other means. A program of frequent damp cleaning, including carpet washing with water only, is often an effective short-term response while efforts are made to identify and eliminate the source of the irritation. Cleaning by wiping rather than vacuuming is recommended, unless the vacuum is equipped with a HEPA (high-efficiency) filter, since more dust may become airborne as a result. Use of humidifiers or air purifiers can be of tremendous benefit if the affected space is not too extensive. It may be worthwhile for some employees to seek the advice of a dermatologist or other medical specialist, since simple skin treatments (such as the use of moisturizers and milder soaps) are frequently used to minimize problems with irritation.

Technical Assistance and Identification of Pests

Additional information concerning specific problems, identification of insects, technical advisory assistance and training and licensing information may be obtained from the following agencies:

Illinois Pest Control Association, 625 S. Second St., 2nd floor, Springfield, IL 62704 (800-975-9344 or 217-241-0232)

Illinois Department of Public Health, Division of Environmental Health, 525 W. Jefferson St., Springfield, IL 62761 (217-782-5830, TDD [hearing impaired only] 800-547-0466).

University of Illinois Extension, Plant Clinic, 1401 St. Marys Rd., Urbana, IL 61801 (217-333-6650; TDD: 217-244-6677)

Acknowledgments

The members of the Structural Pest Control Advisory Board provided valuable comments during the development of this publication. The illustrations in Appendices I and II were slightly modified.

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Correspondence Courses

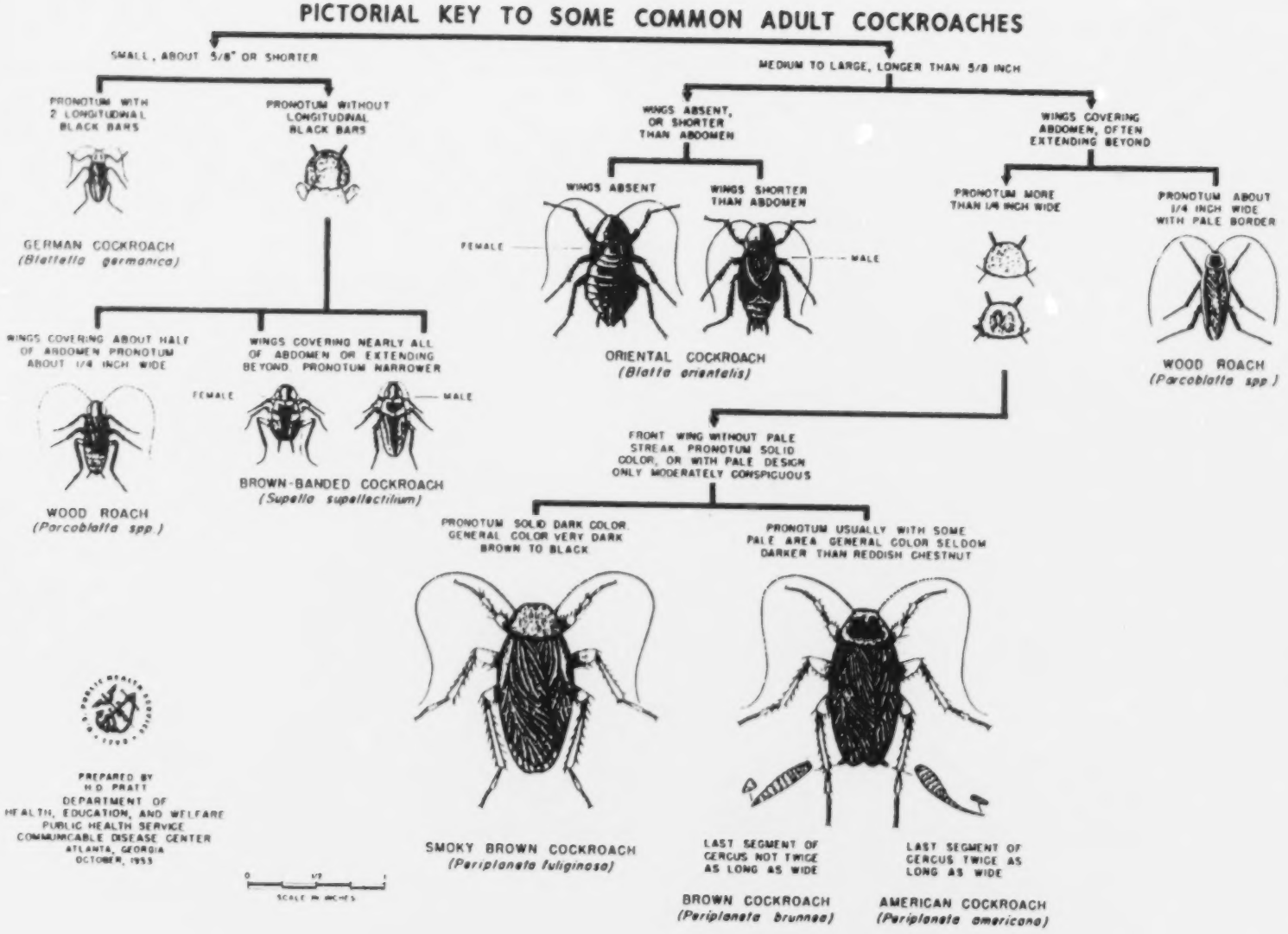
Individuals may wish to take one of the following correspondence courses to increase their expertise in IPM.

Pest Control Correspondence Course. Continuing Education Business Office, 1586 Stewart Center, Room 110, Purdue University, West Lafayette, IN 47907-1586.

Vector-Borne Disease Control -- No. 3013-G. [Although the emphasis is on control of pests of public health importance, the materials for this course contains much information on the management of structural pests.] Centers for Disease Control and Prevention, Self Study Office, Building 2, Room B-50, FO2, 1600 Clifton Rd., NE. Atlanta, GA 30333.

Appendix I

Pictorial Key to Some Common Adult Cockroaches


PICTORIAL KEY TO SOME COMMON ADULT COCKROACHES
SMALL, ABOUT 5/8" OR SHORTER
MEDIUM TO LARGE, LONGER THAN 5/8 INCH
PRONOTUM WITH 2 LONGITUDINAL BLACK BARS
PRONOTUM WITHOUT LONGITUDINAL BLACK BARS
GERMAN COCKROACH (Blattella germanica)
WINGS ABSENT, OR SHORTER THAN ABDOMEN
WINGS COVERING ABDOMEN, OFTEN EXTENDING BEYOND
WINGS ABSENT
WINGS SHORTER THAN ABDOMEN
FEMALE
MALE
ORIENTAL COCKROACH (Blatta orientalis)
PRONOTUM MORE THAN 1/4 INCH WIDE
PRONOTUM ABOUT 1/4 INCH WIDE WITH PALE BORDER
WOOD ROACH (Parcoblatta spp.)
WINGS COVERING ABOUT HALF OF ABDOMEN PRONOTUM ABOUT 1/4 INCH WIDE
WINGS COVERING NEARLY ALL OF ABDOMEN OR EXTENDING BEYOND. PRONOTUM NARROWER
FEMALE
MALE
WOOD ROACH (Parcoblatta spp.)
BROWN-BANDED COCKROACH (Supella supellectilium)
FRONT WING WITHOUT PALE STREAK. PRONOTUM SOLID COLOR, OR WITH PALE DESIGN ONLY MODERATELY CONSPICUOUS
PRONOTUM SOLID DARK COLOR. GENERAL COLOR VERY DARK BROWN TO BLACK
PRONOTUM USUALLY WITH SOME PALE AREA. GENERAL COLOR SELDOM DARKER THAN REDDISH CHESTNUT
SMOKY BROWN COCKROACH (Periplaneta fuliginosa)
LAST SEGMENT OF CERCUS NOT TWICE AS LONG AS WIDE
LAST SEGMENT OF CERCUS TWICE AS LONG AS WIDE
BROWN COCKROACH (Periplaneta brunnea)
AMERICAN COCKROACH (Periplaneta americana)
0
1/2
1
SCALE IN INCHES

PREPARED BY
H.D. PRATT
DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
COMMUNICABLE DISEASE CENTER
ATLANTA, GEORGIA
OCTOBER, 1953

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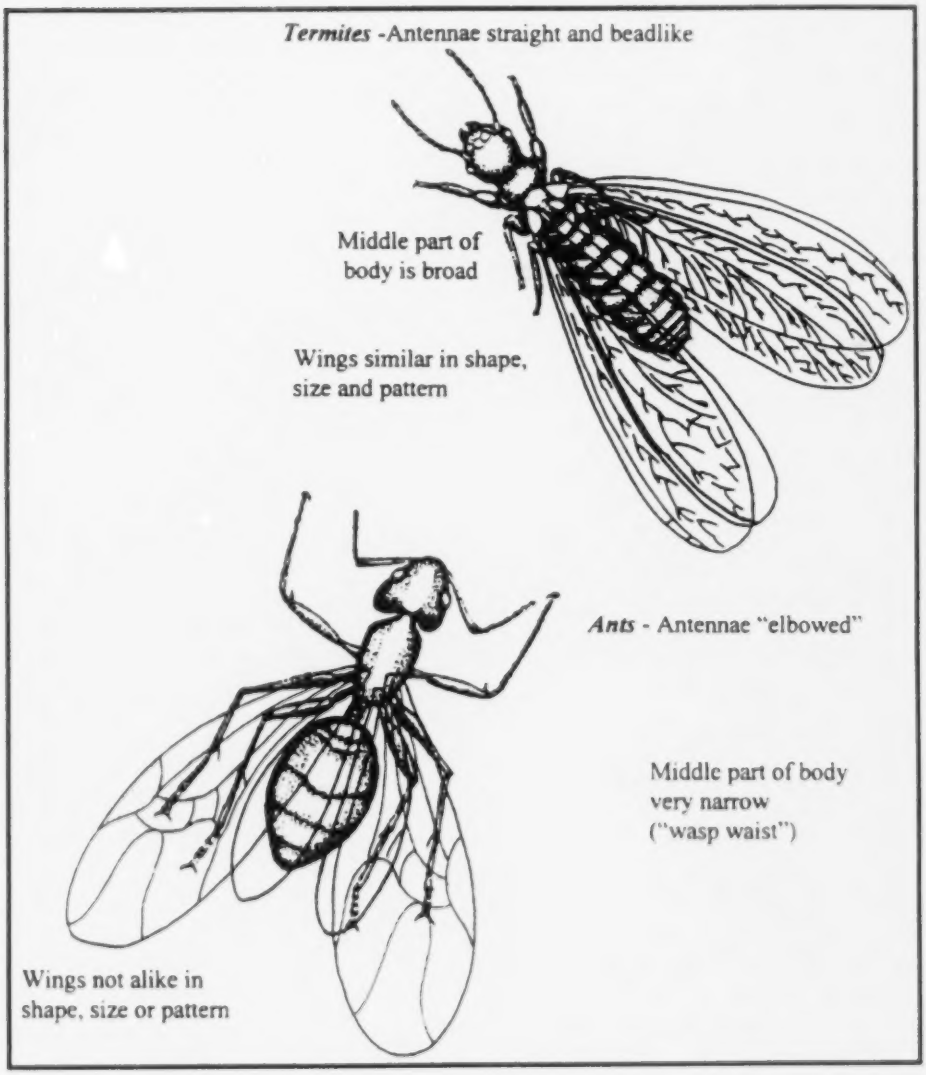
Appendix II

Distinguishing Termite and Ant Swarmers (Reproductives)


Termites -Antennae straight and beadlike
Middle part of body is broad
Wings similar in shape, size and pattern
Ants - Antennae "elbowed"
Middle part of body very narrow ("wasp waist")
Wings not alike in shape, size or pattern

Illinois Department of Public Health
Division of Environmental Health
525 W. Jefferson St., Springfield, IL 62761
217-782-5830 TTY (hearing impaired use only) 800-547-0466.
Email: mailus@idph.state.il.us

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